

No. XI.—ON THE CEPHALOPODA OBTAINED BY THE PERCY SLADEN
TRUST EXPEDITION TO THE INDIAN OCEAN IN 1905.

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(COMMUNICATED BY PROF. J. STANLEY GARDINER, M.A., F.R.S., F.L.S.)

(Plates 65, 66, Text-figs. 1—6.)

Read 17th June, 1915.

AN examination of the Cephalopoda obtained by the "Sealark" on her cruise in the western regions of the Indian Ocean has been delayed since the return of the expedition in 1905 until the beginning of the present year [1914] when Prof. Gardiner placed them in the author's hands.

The collection consists of eighteen species representing ten genera and includes a new genus and two new species. Although no very remarkable forms were obtained, the collection as a whole is not without interest, while some of the anatomical features revealed by dissection are of importance.

A peculiar feature of this collection is the total absence of *Myopsida* (*Loligo*, *Sepia*, etc.). This group usually being of a littoral habitat their absence in conjunction with the relatively large number of pelagic and abyssal forms might be taken to shew that the "Sealark's" work was confined to deep-sea dredging or tow-netting far from land. This however was not the case. As will be seen from a study of the stations from which the various species were obtained some of the Polypods were taken at very moderate depths off the islands at which the "Sealark" touched: so that the absence of *Myopsida* is difficult to account for.

In the present state of our knowledge of the group, Cephalopoda are a rather unprofitable class for use in zoogeographical studies. Those that are well known (the Polypods, squids and cuttlefish) have usually a very extensive range (or what appears to be so), being for the most part powerful swimmers. For example, *Polypus fontanianus* ranges from Chili to the Indian Ocean; while *Stenoteuthis bartramii* is cosmopolitan. The delicate abyssal forms, on the other hand, are so little known at present that it would be useless to generalize on their distribution.

We have also to bear in mind the fact that the diagnoses of a great many species of Cephalopoda are based upon external characters of doubtful value, and that a different view of their distribution may be taken when students of this group have paid more attention to the description of internal parts. Distributional areas at present ranging over many degrees of latitude and longitude may by this process become more restricted. The habits of the majority of these animals, however, do not leave much ground for

assuming that they will ever prove as interesting to the zoogeographer as land and fresh-water mollusca have been.

Whenever possible, attention has been paid to the anatomy of the forms included in this collection, and several points of interest have been revealed. The author has been struck, while in the course of this work, with the necessity for a more intensive study of these animals for the purposes of systematic zoology. Any worker familiar with the Cephalopod mandible and radula will recall how at first sight these structures differ to a remarkably slight degree in forms placed very widely apart. It seems likely, however, that closer study will reveal differences between the radulæ of such forms. The author has been impressed by the way in which, in apparently similar radulæ of forms otherwise very distinct, certain elusive and subtle differences may remain constant over a series of examples. The shells of certain groups of land mollusca have been separated into a number of species which, to the ordinary observer, exhibit very little difference one from another. It is claimed by conchologists that the differences between them are constant, however subtle and minute they may be. Very much the same sort of thing may be found by intensive study among the Cephalopoda.

Among the internal organs the author has found that the genitalia and heart are frequently strongly characterised; and it often seems that for a provisional arrangement these organs would supply a more useful clue to identity than the radula and mandible. On the other hand due care has to be exercised, especially with regard to the heart, that characteristics such as are probably occasioned by the temporary physiological state of such organs are not registered as of diagnostic value.

The author is indebted to Dr W. E. Hoyle for information with regard to the Cranchiidæ, and to the Rev. Dr H. M. Gwatkin for the loan of a series of radula-preparations which has been of great value in determining the affinities of certain forms.

The types and a series of other specimens have been presented by Prof. Gardiner to the British Museum.

The following arrangement has been adopted from Pelseneer (14), Pfeffer (16), and Chun (2).

Class CEPHALOPODA.

Order 2. DIBRANCHIA.

Suborder 1. DECAPODA.

Tribe I. ŒGOPSIDA.

Œgopsida libera.

Family 2. **Onychoteuthidæ.**

Onychoteuthis, sp. (immature).

Teleoteuthis, sp. (immature).

3. **Enoploteuthidæ.**

Abralia (*Compsoteuthis*), sp. (immature).

„ sp. (immature).

Family 6. **Benthoteuthidæ.***Chunoteuthis minima*, n. gen., n. sp.8. **Ommatostrephidæ.***Stenoteuthis bartramii* (Le Sueur).11. **Chiroteuthidæ.***Chiroteuthis* (*Doratopsis*) *exophthalmica* Chun.**Ægopsida consuta.**Family **Cranchiidæ.**S.-fam. i. **Cranchiinaæ.***Liocranchia gardineri*, n. sp.S.-fam. ii. **Taoniinaæ.***Taonidium*, sp. (immature).

Suborder 2. OCTOPODA.

Tribe II. TRACHYGLOSSA.

Family 3. **Polypodidæ.***Scaeurus unicirrhus* Tiberi.*Polypus fontanianus* D'Orb.„ *arborescens* Hoyle.„ *gardineri* Hoyle.„ *horridus* D'Orb.„ ? *venustus* Rang.„ *granulatus* Lamarck.„ *L.* Hoyle.„ *P.* n. sp. (?).ÆGOPSIDA. Family 2. **Onychoteuthidæ.**1. *Onychoteuthis* sp.

One example, sex indeterminate, young, from lat. 20° S. between Maldives and Chagos, 50 fms. (1537).

One example, sex indeterminate, young, from between Salomon and Diego Garcia, Chagos, surface (1540).

These examples are very immature, but they exhibit considerable resemblance to young examples of this species figured by Pfeffer (16).

2. *Teleoteuthis*, sp.

Two examples, young (7—8 mm.) from Amirante Bank, surface (1539).

Four „ „ „ ? locality (1409).

The above enumerated examples have been referred to this genus with much hesitation. The general appearance is in fairly close conformity with young figured specimens referred to the genus, (10) and (13); but they are rather more elongate than is apparently

usual at this stage and the arms are shorter than customary. The suckers of the tentacular arms are arranged in a formation more closely serried than those figured by Pfeffer and Chun.

Family 3. **Enoploteuthidæ.**

Abralia (*Compsoteuthis*), sp.

One example, sex indeterminate, from off Providence, between surface and 10 fms* (1536).

The specimen is in a very poor condition, the head and arms being damaged, but from the characters that are apparent it is probably referable to this genus.

Another very badly damaged specimen from 250 fathoms off Desroches Atoll (1532) is possibly referable to *Abralia* also.

Family 6. **Benthoteuthidæ.**

Chunoteuthis minima, n. gen. n. sp. (Plate 65, fig. 2).

One example, sex indeterminate, from between Alphonse and Providence Islands, 900 fathoms (1528).

This specimen has been the source of a considerable amount of trouble. In the first place, it arrived in a very shrivelled-up condition, apparently having suffered desiccation at some time, and in consequence a good many of its external features have been obliterated. In the second, it does not readily fall into line with any described and figured Cegopsid genus. Even its family relationships are very doubtful. The result is that, although it certainly calls for description, its exact position is extremely problematical, seeing that examination of the anatomy and mantle cavity is denied by the state of its preservation. After much hesitation it has been decided to assign it to the Benthoteuthidæ on the strength of its general superficial appearance.

Chunoteuthis, n. gen.

General appearance. Very small in size* (length of mantle from apex to base of arms, 3 mm., length of tentacular arms, 5.5 mm. (? + 1 mm.), width 1 mm.). The head is large and oblong in shape with very large, prominent eyes upon which no traces of accessory light organs are to be seen. The body is saccular but laterally compressed† with a well-marked dorsal carina and a very prominent nuchal protuberance on the dorsal mantle edge. Posteriorly two small subquadrate fins are found.

The tentacular arms are very long and slender. The club is not very much expanded and the suckers upon it are irregularly disposed. The sessile arms were so tightly entangled that they could not be separated without damage. They are relatively long and apparently subequal in size, and all exhibit prominent suckers.

The colouring has of course disappeared, but traces of dark chromatophores appear upon the arms.

C. minima, n. sp., with the characters of the genus.

Type in the Zoological Department of the British Museum.

* The adult condition is testified by the length of the arms both sessile and tentacular.

† It is not impossible that the lateral compression may be an artefact character.

Family 8. **Ommatostrephidæ.** *Stenoteuthis*.

S. bartramii (Le Sueur). (Plate 66, fig. 1.) Journ. Acad. Nat. Sci. Philadelphia, ii. pt. 1. 1821. 90 t. 7. (For a full synonymy cf. Pfeffer (16).)

Two examples, ♂ (young), "flew on board" 30 miles W. of the Centurion Bank (Chagos Is.), (1416).

A complete account of the anatomy of this cosmopolitan form is very desirable on account of its peculiar "flying" habit. Unfortunately the amount of material to hand prohibits the preparation of such an account in the present instance; nor, in fact, does the condition of the animal here described from dissection, favour a satisfactory account, particularly with regard to the genitalia.

The *branchiæ* are slender and elongate resembling a quill pen in general appearance. They are relatively very long, in individuals of 80 mm. length measuring 33—34 mm. There are 56 (± 1) laminae, the distal ones being very minute. The scheme of plication, which is tolerably simple, is shewn in fig. 1 c.

The *anus* exhibits two lateral valves, elongate and auriform in appearance.

Internal anatomy.

The *heart* (fig. 1 b) is fairly regular in shape and is elongate in its sagittal axis. The anterior and posterior aortæ originate at the anterior and posterior extremities. In the two specimens there were no traces of auricles. It is possible that the swellings at the base of the efferent vessels represent these.

The *branchial hearts* are large, irregularly-shaped organs, each exhibiting an appendix and partly separated from it by a very deep groove in which the afferent vessel terminates.

Posteriorly the posterior vena cava appears to arise from two very long and narrow blood sinuses. From one of these a main vessel was found debouching into the vena cava. On the other side the specimen was too badly preserved to allow dissection to trace a similar connection; though there is no reason to suppose an asymmetrical condition.

Such blood sinuses are apparently rare in the Cephalopoda and may be in some way related to the animal's habit of "flying" or leaping from the water.

The *renal papillæ* are found about 2 mm. from the base of the *branchiæ* between the latter and the intestine.

The *stomach* appears to bear two appendices (fig. 1 a), one of these a rounded sac lying anteriorly, the other a narrow elongate structure occupying a terminal position.

The first appears to be plicate internally and may represent the true stomach described for *Loligo pealeii* by Verrill (18), while the second may be the equivalent of his "caecal lobe" described for the same animal.

The *testis* is a thin elongate organ closely applied to the left-hand blood sinus and terminating anteriorly in a piriform mass of coiled tubes, the external aperture being dorsal to the gill heart and just near its posterior extremity. From this aperture project the ends of two tubules, apparently the terminal portion of Needham's sac and the prostate (?). It is very much to be regretted that the condition of the single animal available for dissection precluded a complete examination of the genitalia.



It may be taken for granted that this animal does not "fly" in the strict sense of the word, i.e. it does not maintain itself or effect progress by repeated muscular efforts out of the water. It should more correctly be called the "leaping squid," as it is pretty clear that by the action in question it merely projects itself from the water by a single effort. It has been suggested that the occurrence of the animal out of the water may possibly be merely accidental. It is a powerful swimmer and it is possible that in a rough sea it might accidentally shoot out of the water when swimming close to the surface. From D'Orbigny's account (4), however, in which he describes the considerable altitude (15—20 feet) to which it leaps and the way it is preyed on by sea-birds, I am inclined to think it executes the characteristic leap voluntarily in order to escape from its enemies. D'Orbigny says the habit has been observed in some species of *Sepioteuthis* as well. He is of opinion that it is effected by the well-developed fins on the arms; but, however much the latter may facilitate the leap, they can scarcely initiate it. The latter function is probably performed by the powerful trunk muscles exercising an abnormal pressure on the contents of the mantle cavity. It is possible that the power is possessed by a good many other squids, but has only been observed in *S. bartramii* by reason of its plentiful occurrence.



LIOCRANCHIA GARDINERI: Fig. 1, Mandibles; Fig. 2, Radula. A. Admedian tooth. (Cam. $\frac{1}{12}$ nom. imm. $\times 6$ oc.)

Family 11. **Chiroteuthidæ.** *Chiroteuthis*. Subgenus *Doratopsis*.

Chiroteuthis (*Doratopsis*) *exophthalmica* Chun. Deutsche Tiefsee-Expedition. Bd. 18, T. i. p. 290, 1910.

A single specimen, sex indeterminate, from between Peros and Salomon, Chagos, 600 fms. (1535).

Distribution previously known: Madeira and South Indian Ocean.

The specimen is very much damaged, only the head, tentacles and a small part of the body remaining. The identification is provisional.

Family **Cranchiidæ.** *Liocranchia*.

Liocranchia gardineri, n. sp. (Plate 65, fig. 1 and Text-figs. 1 and 2.)

One example, sex indeterminate, from off Desroches Atoll, 200 fms. (1530).

It is very much to be regretted that only a single specimen of this interesting form was obtained, as owing to the size and structure it is impossible to dissect out any of the internal organs or even to open the mantle cavity without seriously damaging the specimen.

Dimensions. Max. length of body (apex—base of arms), 10 mm.

„ width „ „ 7 mm.

Length of tentacular arms, 9 mm.

The surface of the *mantle* is smooth, semi-transparent, and of a faint ochreous colour. A number of small dark-red chromatophores are found dorsally scattered sparsely over the posterior half and disappearing anteriorly and ventrally. A couple of chromatophores appear in a dorsal position on the head, one on each side of the median line.

The body is saccular and rounded posteriorly, where, in a subterminal position, a pair of small quadrate fins appear on the back.

The *funnel* is large and projects more than 2 mm. beyond the edge of the mantle.

The *sessile arms* exhibit the formula 3. 4. 2. 1.

The *tentacular arms*. Only one of them is complete. They are solid, truncheon-like structures for more than 2.5 mm. of their length, after which they rapidly taper to a very fine strand continued to the “club” which is 2 mm. long and well developed.

The lateral and admedian cartilaginous rows are furnished with numerous pyramidal tubercles. There are no median dorsal cartilaginous tubercles as in *L. reinhardti*.

The *mandibles* (cf. Text-fig. 1).

The *radula*. The admedian lateral tooth is enlarged so as almost to match the second lateral in size. There would appear to be no small marginal tooth, though it is impossible to be certain of this point.

Type in the Zoological Dept. British Museum.

Cranchiidae. S.-fam. ii. **Taoniinae.**

Taonidium, sp.

A damaged example, sex indeterminate, juvenile, “16:5:05,” from 125 fathoms (1534).

Possibly referable to *T. suhmi* (Hoyle).

Family **Polypodidae.** *Scaurgus*.

Scaurgus unicirrhus Tiberi. (Plate 66, fig. 2.) Bull. Soc. Malac. Ital. 1880, p. 5 (after Delle Chiaje, n. n.).

One example, ♀, from 123 fms. S. de Malha (1406).

„ ♂, „ 125 „ „ (1404).

Distribution previously known: Mediterranean region.

The examples are unmistakably representatives of this species, which as far as the author has been able to satisfy himself, has never been previously recorded E. of the Mediterranean area.

It is desirable to add some further notes to the already existing knowledge of the anatomy of this form. One or two points appear to be of considerable importance.

To the description of the *hectocotylus* given by Jatta (9) we may add the fact that there is no communication between the main sperm-path (the marginal sulcus) and the deep cleft at the extremity of the hectocotylus described by Jatta (p. 237). The function of this cleft is therefore somewhat difficult to understand, unless we assume that the whole extremity is applied as a sucker for prehensile purposes.

The *male genitalia* have been already described by Marchand (13) and do not appear to differ in any important respects from those of *Polypus*.

The *female genitalia* in this species appear to differ from those of *Polypus* somewhat (fig. 2). The oviducts leave the ovary in the form of broad, strap-like ducts, narrowing down as they approach the oviducal glands. The latter are relatively very large. The anterior portions of the oviducts do not again contract on quitting the oviducal glands but continue as stout muscular tubes to the oviducal aperture which is situated upon a round elevated papilla of characteristic shape surmounted by a tuft of small (possibly glandular) lobes which surround the aperture.

Coelom and coelomic organs. The limits of the *kidney* are shewn in fig. 2. It is a voluminous organ and possesses extensive glandular bodies. It is divided by the afferent and efferent branchial vessels into three portions, the long axes of which are transverse in two cases, antero-posterior in the third. The latter is small and contains the reno-pericardial orifice which is situated at a very short distance from the entrance to the renal orifice; while the former are extensive and ramify among the digestive organs in such a way as to make it difficult to follow them.

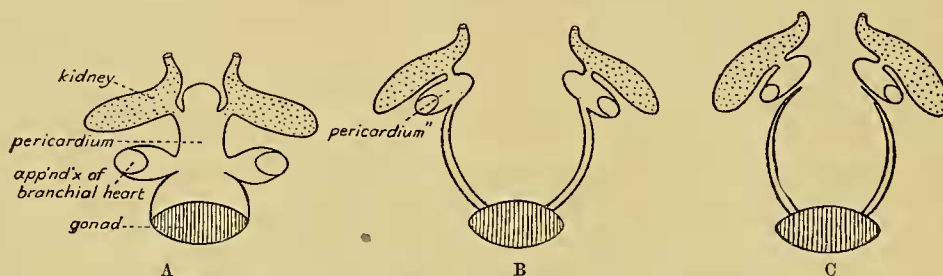


Fig. 3. A. DECAPOD. B. POLYPUS. C. SCAEVURGUS.

The so-called *aquiferous duct* leaves the capsule of the ovary from a very anterior position and running backwards comes into close contact with the pericardium in the external tissues of which it runs as a fine fibrous strand gradually diminishing in size until it entirely vanishes near the apex of the pericardium. Very careful dissection of both sides failed to reveal any opening of this duct into the pericardium. If this observation should be confirmed by future investigators, it will be permissible to suppose that morphologically *Scaevurgus* carries us a step further than *Polypus* in the obliteration of the coelomic cavity, and would represent the third stage in the annexed diagram in which the gradual reduction of the coelomic cavity of the Cephalopoda is illustrated (Text-fig. 3).

This process of separation of the gonad from the remnant of the coelom would be finally completed by the condition observed in *Argonauta* and *Philonexis* in which the aquiferous canals are suppressed altogether (Pelseneer (14)).

It is necessary to emphasize the fact that these observations are founded upon dissection of a single specimen and that due caution is necessary in employing them for any generalization.

The *anus* is in the form of a transverse slit at the lateral extremities of which are found pedunculate flaps of skin which apparently function as valves and are capable of being folded over the aperture.

The *heart* (fig. 2 a) is asymmetrical, rectangular on the left side and drawn out by the

posterior aorta upon the right side. Between the right and left efferent vessels and the anterior aorta are found two small vessels which run to the surface of the renal capsules. The genital artery leaves the heart in a median position in the antero-ventral region. The auricles are small, simple and roughly triangular in shape.

The *branchiæ* are shewn in fig. 2 *b*.

Polypus.

1. *P. fontanianus* (D'Orbigny). (Plate 66, fig. 5.) Amérique Méridionale, p. 28, 1835.

One example, ♀, Coetivy (1405).

Distribution previously known: Peruvian and Patagonian regions. Indian Ocean.

Originally regarded as a South American form, this species has recently been recorded from the Indian Ocean (Joubin (12)). The enlargement of the proximal suckers of both lateral arms, regarded by D'Orbigny as a character diagnostic of the species but now found to be a sex-limited character found in other species, has been already discussed by Hoyle (5). It may possibly serve a prehensile function similar to that discharged by the enlarged thumb of male frogs. Insemination being effected among the Cephalopoda by means of the hectocotylus it would appear unnecessary for the male to be supplied with prehensile organs. Very little, however, is known of the actual process of sperm-transference and coitus, and it may be possible that some form of amplexus takes place in some species of *Polypus* in which the enlarged suckers seen in *P. fontanianus* and *P. gardineri* are used. That amplexus may take place in some members of a genus and not in others is attested by Boulenger's description (1) of fecundation in Batrachians, according to which amplexus occurs in *Molge aspera* and *M. montana* but not in *M. cristata* and *M. alpestris*.

The *mandibles*. The upper is erect and exhibits a well-pointed rostrum; in the lower the anterior laminæ are provided with a marked posterior median angulation.

In the *radula* the median tooth appears to exhibit three phases, one with lateral cusps placed about half-way down from the apex of the median cusp, one with similar cusps placed lower down and one with cusps in both positions. The third lateral tooth is stout, recurved at the tip and its base is well developed.

The *anus* is situated within a circular depression in the mantle cavity and is furnished with two elongate valves.

The *heart* is markedly asymmetrical. The genital artery leaves it towards the right side, the anterior aorta well on the left with the root of the posterior aorta occupying the opposite angle. Shortly after it leaves the ventricle the anterior aorta gives off a small vessel which apparently runs to the stomach and intestine.

The right auricle was found to be in an abnormal condition inasmuch as it was enlarged to a size exceeding that of the ventricle itself. Dissection revealed the presence in it of a mass of coagulated blood. The left auricle being, as is usual in the Cephalopoda, of small size, one is forced to conclude that the distension of the right auricle is abnormal, due either to pathological causes or to some temporary derangement of the circulation due possibly to the circumstances of the animal's death.

The *genitalia* (♀) do not call for any particular comment. The oviducal glands are very small, the ovary is symmetrical and the oviducal apertures are simple and placed very near the anus. The genital artery enters the capsule of the ovary in an anterior position between the two ducts which are separate at their origin.

The *branchiæ* (fig. 5 *b, c*) have their laminae diagonally plicate.

2. *Polypus arborescens* Hoyle. (Plate 66, fig. 3.) Rept. Pearl Oyster Fisheries of Ceylon, (Roy. Soc.) Pt. II. p. 189, 1904.

One example, ♀, from Cargados, 30 fms. (1411).

One example, ♀, from same (1403) (dark variety?).

These are unmistakable examples of Hoyle's species.

Distribution previously known: Ceylon; Zanzibar; Pacific Ocean.

The *mandibles* (cf. fig. 3 *b*).

The *radula*. The first lateral tooth is rather deep, the second singularly long and accompanied by a rather slender third lateral. The median tooth exhibits a very deep basal notch.

The *internal organs*. In the example No. 1411 the ovary was so much enlarged and reflected posteriorly that it covered the whole of the branchial complex and practically obscured the gills themselves from view. Apparently by reason of this development of the ovary (no doubt attained by numerous other species at the time of sexual maturity) the following somewhat anomalous condition of the branchial complex and surrounding organs is to be noted:

- (i) the gills lie at a very low level,
- (ii) the heart is displaced very much to the right of the median line,
- (iii) the oviducts instead of originating from the dorsal surface of the ovary and running downwards are found well past the middle of the mantle cavity on the ventral side of the ovary, running first upwards and then downwards.

The other example, which is very much darker in colour, shewed no such development of the ovary, the gills were more posterior in position and the oviducts pursued a more normal course. The heart, however, is still placed well towards the right-hand side. Comparing the two examples we may safely conclude that at sexual maturity the extensive development of the ovary tends to displace the organs of the branchial complex in the manner described above.

In both forms the *heart* is peculiarly elongate and piriform, the posterior aorta occupying the apex and the two efferent vessels and the anterior aorta the base.

3. *Polypus gardineri* Hoyle. Fauna and Geography of the Maldivé and Laccadive Archipelago (J. S. Gardiner). Cephalopoda. Vol. ii. Supp. 1. p. 976.

One example, ♂, from Coetivy, 32 fathoms (1419).

It was impossible to make any dissection of this example owing to the imperfect state of preservation. Superficially it agrees in all respects with Hoyle's type description, the lateral arms exhibiting enlarged suckers (v. supra, p. 437).

Hoyle supposed that this form might possibly be the young of *P. fontanianus*; but comparison of the radula of these two forms does not support this possibility.

The *hectocotylus*. This was referred to by Hoyle as comparable to that of *P. vulgaris*. It should however be pointed out that in the present example of *P. gardineri* the hectocotylus differs from that of *P. vulgaris* in that the seminal groove is well covered over by its external edge, though it is possible that the loose external edge may be contracted or relaxed according to the state of preservation.

The *radula* (Text-fig. 4).

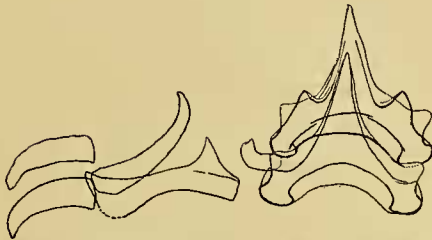


Fig. 4. *POLYPUS GARDINERI*: Radula.
Cam. 6 oc. \times 6 obj. Reich.



Fig. 5. *POLYPUS HORRIDUS*: Radula and Mandibles. Cam. 6 oc. \times 6 obj. Reich.

4. *Polypus horridus* D'Orb. Tabl. méthod. Ann. Sci. Nat. vii. p. 54, 1826.

One example, ♂, from Amirante, 20—25 fathoms (1418).

„ ♂, „ 25—80 „ (1401).

„ sex indeterminate, young, Amirante, 30 fathoms (1420).

Distribution previously known: Zanzibar; South Africa; Red Sea; Ceylon; Malé Atoll.

Mandibles. The distal extremity of the anterior ramus of the lower mandible is markedly turned back and expanded. The upper mandible is very erect and anteriorly presents a remarkably straight front.

Radula. The first laterals are elongate. The second laterals exhibit a very heavy external inferior angle, while the third laterals are tolerably stout. (Text-fig. 5.)

5. *Polypus venustus* Rang. Magasin de Zoologie, Ann. 5–8, 1835–8, fig. 93.

One example, ♀, from between Peros and Salomon, Chagos, 20 fathoms (1541).

The author has been unable to find any modern work upon this species. There is a brief reference to it in Tryon's Manual of Conchology, vol. I, where the distribution is given as “Algiers: Island of Goree.” Tryon places it among his indeterminate species and considers it to be a young specimen.

The specimen obtained from the above locality agrees with Rang's description (and figure) pretty closely. In one or two respects it differs, e.g. the chromatophores are not aggregated into a median dorsal clump but are found clustered towards the anterior end of the mantle. Nor are the ventral chromatophores disposed in the sparse even rows indicated by Rang's figure but are more irregularly distributed. Otherwise the description given by Rang applies very adequately to this specimen. Particularly significant is the agreement on the following characters: “un peu dorée à la partie dorsale” and “les bras... avec des séries de petites taches dorées répondant aux ventouses.”

Tryon's supposition that this is a young form is borne out by the delicacy and fragility of the tissues but by nothing else. The condition of the arms and suckers and the general appearance, which is peculiar and characteristic, do not suggest that it is young.

It is very much to be regretted that only a single specimen was found, otherwise some interesting anatomical characters might have been revealed. The branchial cavity alone was opened and found to reveal at least one interesting feature. As far as the radula is concerned there is nothing to separate it from a normal *Polypus*, but the single mandible examined is somewhat peculiar.

The *branchiae* occupy a peculiar position in the mantle cavity, being inserted into the visceral mass at a remarkably high point, well up into the apex of the mantle cavity. In form they are extremely long, flat and strap-like.

The *radula* (Text-fig. 6) is normal. In the median tooth there appear to be two main lateral cusps, the separation and approximation of which in different teeth give rise to two main types indicated in the figure.



Fig. 6. *POLYPUS VENUSTUS*: Radula. Cam. 6 oc. \times 6 obj. Reich.

The *lower mandible* alone was examined, the upper member of the pair being somewhat damaged. It is peculiar in exhibiting an excessively deep notch and a very small anterior lamina.

Distribution previously known: "Algiers: Goree."

6. *Polypus granulatus* Lamarck. Mém. Soc. Hist. Nat. Paris, i. p. 20, 1799.

One example, about one-third grown, ♀ (?), from Amirante, 22—85 fathoms (1402).

I share Dr Hoyle's view (5, p. 80) as to the difficulty of identifying the *S. rugosa* of Bosc to which this form has been referred by Férussac and D'Orbigny.

7. *Polypus* L. Hoyle. Fauna and Geography Lacc. and Mald. Archip. (J. S. Gardiner), Vol. ii. Supp. I. 1905.

One example, sex indeterminate, young, Amirante, 20—40 fathoms (1407).

This young example agrees in all respects with the form recorded by Hoyle, except that there are two, not three, ventral chromatophores.

8. *Polypus* P. (Plate 65, fig. 3; Plate 66, fig. 4.)

One example, ♀, from off Peros, Diamant Is., 12 fathoms (1410).

This specimen proved to be too young to be treated as a new species. It exhibits affinities with *P. horsti*, *P. fontanianus* and *P. gardineri*, but at the same time appears to be specifically distinct from these forms.

The *body* is posteriorly rounded and sac-like, the eyes are tolerably prominent and between the latter the head is slightly wider than the body. The skin is wrinkled

dorsally, probably by the action of the preserving agent, and exhibits a sparse array of papillæ some of which are multifid. There are a few papillæ round each eye.

The *arms* exhibit the formula $2=3=4.1$. There is a weakly developed *umbrellar membrane* extending a few millimetres up each arm.

The colouring is a brownish purple on the back, passing to a very pale yellowish brown ventrally, the whole covered with numerous black chromatophores. Very characteristic is an oval patch of an intense blue-black colour, about 2 mm. long, situated on either side somewhat posterior to the eye at the base of the third arm. Such patches are found in this position in *P. horsti* (Joubin (12)), but although this is a common characteristic between the two species, the radulæ, as well as other structures, differ too widely to allow of uniting the two forms (cf. Plate 66, fig. 4 a and Text-fig. of Hoyle (6)).

Radula (cf. fig. 4 a).

Internal anatomy. The *heart* is relatively very large and is markedly rounded; the efferent vessels enter it at equal distances from the anterior aorta. The auricles lie very near the surface in close proximity to the renal aperture.

The *ovary*, in accordance with the immature age of the specimen, is very small, much smaller in fact than the capsule. The oviducal glands are also very small and the oviducts long and slender. These open low down in the mantle cavity towards the median line in the region of the kidney.

INDETERMINATE JUVENILE EXAMPLES.

A single very small example from "6. 10. 05," 140 fathoms (1538). The only salient characters are its squat build and the plentiful scattering of brownish-black chromatophores all over the mantle.

A single juvenile example from Providence, 39 fathoms (1408). Possibly young form of *P. granulatus*.

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EXPLANATION OF PLATES.

PLATE 65.

- Fig. 1. *Liocranchia gardineri*, n. sp., anterior and posterior aspects ($\times 5$).
 Fig. 2. *Chunoteuthis minima*, n. gen., n. sp., anterior and posterior aspects ($\times 17$).
 Fig. 3. *Polypus P.*, anterior aspect; 3a, funnel; 3b, oral aspect shewing disposition of suckers ($\times 2$).

PLATE 66.

- Fig. 1. *Stenoteuthis bartrami* Lesueur, general appearance of mantle cavity; 1a, stomach and caeca; 1b, heart; 1c, laminæ of gills, seen from above.
 Fig. 2. *Scaeurus uniccirrhus* Tiberi, genitalia, etc.; 2a, heart; 2b, gill.
 Fig. 3. *Polypus arborescens* Hoyle, female in breeding season; 3a, diagrammatic representation of the heart and female genitalia shewing asymmetrical condition of these organs due to growth of ovary at sexual maturity; the dotted outline shews normal position of these organs; 3b, mandibles; 3c, radula (4 oc. \times 6 obj.).
 Fig. 4. *Polypus P.*, heart and genitalia of female; 4a, radula (4 oc. \times 6 obj.).
 Fig. 5. *Polypus fontanianus* (D'Orbigny), heart shewing enlarged right efferent artery, probably pathological; 5a, ovary, etc.; 5b, gill; 5c, a single gill lamella; 5d, mandibles; 5e, radula.

LETTERING: AA=anterior aorta; A, a=auricle; a.d.=aquiferous duct; b.h.=branchial heart; c.o.=capsule of ovary; e.v.=efferent branchial vessel; GA=genital artery; g.o.=genital aperture; LEV=left efferent vessel; MES.V.=mesenteric vessel; od=oviduct; ov=oviducal gland; PA=posterior aorta; REV=right efferent vessel; r.p.a.=renopericardial aperture; x, y=renal vessels.

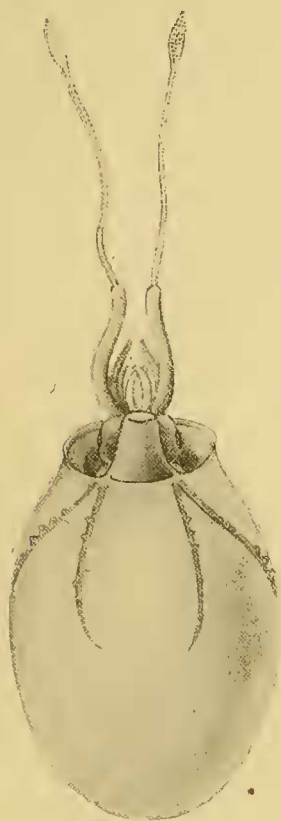


Fig. 1.



Fig. 2.



Fig. 3 a.

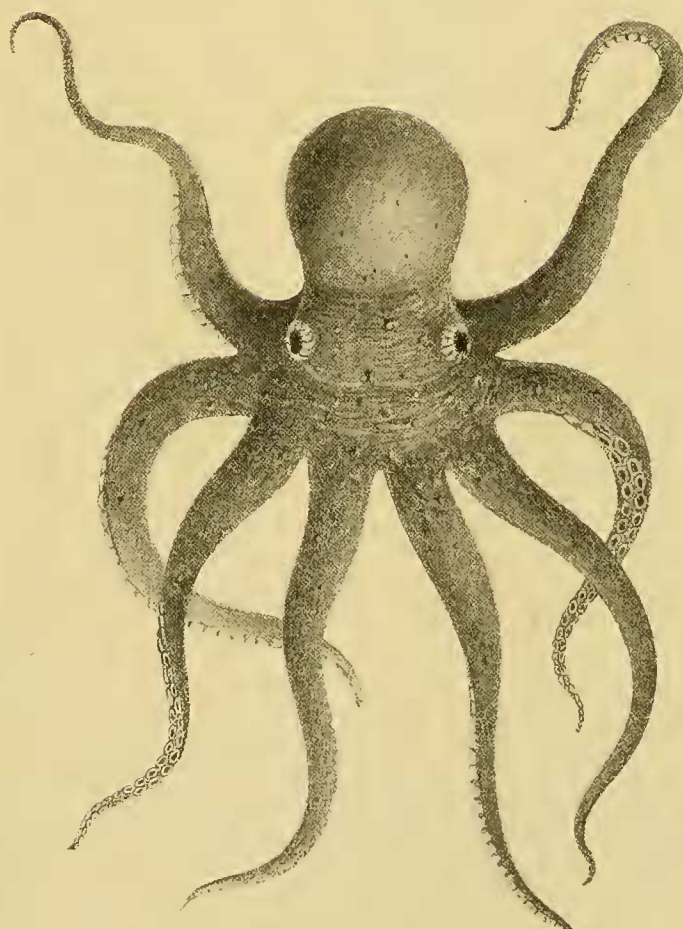


Fig. 3.

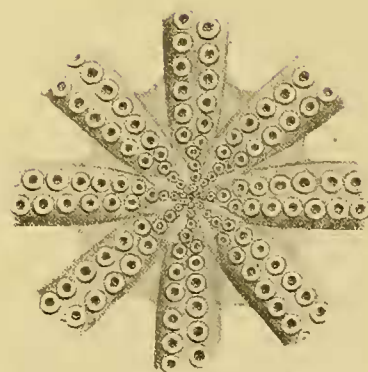


Fig. 3 b.

